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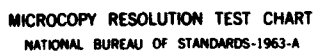
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A VISIT TO THE COMPUTER SCIENCE DEPARTMENT

by

Zhong Qing



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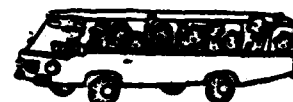
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A VISIT TO THE COMPUTER SCIENCE DEPARTMENT

Zhong Qing



Northwest Industrial University, Nanjing Aeronautics Institute, and Beijing Aeronautics Institute all have computer science departments. Why are computer science departments needed at aeronautics institutes? What's special about them? Can't you figure it out? Let us take you on a tour of the Beijing Aeronautics Institute computer science department!

One afternoon a group of high school students came to Beijing Aeronautics Institute to join a tour of the computer science and engineering departments.

The Computer Synthetic Laboratory

The teachers of the Beijing Institute enthusiastically met the classmates and the first teacher took them on a tour of the computer synthetic laboratory. All sizes and shapes of computers were set up in the laboratory and the students felt very curious and asked all sorts of questions. One student asked, "do the Beijing Institute computer science students study all these computers?" The teacher answered, "the computers you see here are of two general types: mechanical and electronic. These hand cranked electric moving style ones

are mechanical ones. The electronic computer is further subdivided into the electron simulation computer and the electron digital computer. The computer science department at Beijing Institute is an electronic computer department. The computer science major was established at Beijing Aeronautics as early as 1958. At that time we had already studied the electron simulation computer and the electron digital computer and we had constructed an electronic simulation computer. Following the speedy development of computer technology, we are now researching the electron digital computer. The computer science department has set up two specialized fields of study: the computer science system structure field, and the computer software engineering field, the important aspects being in the design, construction, regulation, and applications of small and micro-computers and their systems in the air and in space."

The teacher went up to a line of cabinets and pointing at two small boxes said, "this is an airborne computer used for controlling airplane flight (Fig.1.) The volume must be small, lightweight, and it must work reliably in the air. These are very serious requirements; they are also exactly the special features of the onboard computer. For example, as we all know, the American "Columbia" space shuttle is equipped with five simultaneously used computers constituting a highly dependable and complex computer system. The most outstanding feature of this kind of airborne system of computers is its high reliability and great ability. The space shuttle is a passenger carrying space flying vehicle, goes straight up like a rocket, travels far on an orbit like a man-made satellite, and drops gliding like an airplane making it reusable, therefore the space shuttle computer systems must possess very great reliability and many functions. How is this great reliability ensured? The computer system employs a back-up system which can tolerate mistakes and uses four computers to constitute a four surplus back-up system which executes controls, guides the aircraft, and controls the mission. The four computers receive identical data input, perform

identical calculations operations, send out the same output, and each checks the output of the other three computers to verify it. When one of the computers has an error, an obstruction arises, then the three other computers carry out an operation in triplicate and cut off the problem computer. If an obstruction again arises in another computer the remaining two computers then use comparative self-checking of the problem to guarantee reliable work. And if, by some chance, another obstruction should occur the fifth computer can work independently. Concerning the toleration of mistakes, the checking, and so on, we have established courses to deal with them."

The students felt very interested in the airborne computers. The teacher opened a box cover and pulled out the contents inside and gave in comparative detail the first introduction. On the insert plate from the inside we can see many bits of long rectangular integrated circuits. One piece of large scale integrated circuit can takeover the function of over ten thousand transistors. It is precisely because of this that the onboard computer can be so compact, lightweight, have small power consumption, and be highly reliable.

Also set out on the tables were small sized integrated circuit electron digital computers with integrated circuits made at the Beijing Aerospace Institute. The teacher introduced them to the students saying, "these here are a kind of small computer we have constructed ourselves. It is already in use in earth surface radar systems set up on board aircraft, and can deal with radar data with lightening speed and accuracy, obtain a result, and control the automatic picture receiving set up and draw out the aircraft orbit plan. It can also be used in large testing facilities which deal with data and carry out real time treatment for each kind of measurement data. These small computers have a wide variety of applications, but now they are being replaced with micro-computers.

The Micro-computer Laboratory

After finishing the tour of the synthetic laboratory the teacher led the students to see the micro-computer laboratory and told them about it.

"In the last few years, the development of the micro-computer has proceeded with great speed; according to estimates the number of micro-computers in use has already reached more than 10 million units throughout the world. China has also introduced from outside many micro-computers and simultaneously produced many types of micro-computers. Although the volume of the micro-computer is very small, its capabilities are not. Let's take the F8 micro-computer and compare it to the world's first computer, "Eniac", for a minute. Eniac was constructed using more than ten thousand electron tubes was of unstable ability, often broke down, had a power uptake of 140,000 watts, weighed more than 30 tons, and filled up completely a room of 170 square meters. The F8 micro-computer on the other hand, has a volume 1/30,000th of Eniac, weighs less than half a kilo, has a power uptake of only 2.5 watts, but is 20 times as fast as Eniac and more than 10,000 times as reliable.

"From this we can see that the micro-computer has a very small volume, is very light, has a small power uptake, and is very reliable; especially suitable for flight use. For this reason micro-computers are an important part of studies here at the computer science department. We especially established a course, "Micro-computers and their uses in flight", to let students get experience in the laboratory organizing these micro-computers themselves, and carry out experiments into the uses of micro-computers, thus bringing theory and practice together."

The teacher led the students to see the micro-computer development system and continued explaining.

"This micro-computer development system placed here in the laboratory has a magnetic plate, keyboard-display device, a printer, and generally a complete facility. We can carry out work in the development of software and hardware of micro-computers and can also research expanding the uses of the micro-computer hardware and software in many areas. This offers us good conditions under which to carry out our micro-computer systems research."

The Software Applications Laboratory

From the micro-computer laboratory, the students were taken to the software applications laboratory. They all had to put on clean shoes before being allowed to enter the room. One large room was divided in two by a glass wall. The outer room was set up with rows of terminals (Fig.2.) with keyboards, display screens, and boxlike tape recording apparatus for the terminal practice courses of the micro-computer system students and other software laboratory courses. Mathematical and language courses of the other departments also do computer problems here. The interior room has two big cabinets, the main machines of the electronic computer, with magnetic plate machines, tape machines, card input machines, a printer, and other elements of a complete facility. This is the machine room. To guarantee orderly work, generally only technicians wearing cleaned clothing are allowed to enter.

The teacher in the laboratory explained:

"Here, every semester, we must admit close to 1,000 students and teachers for practical studies. Computer software classes such as "operation systems", "translating and editing techniques", "data structure" and so on all use this computer and its rows of terminals for their studies. The students draw up and correct programs themselves, punching the keyboards and watching the display screens. If a mistake is discovered it can be quickly corrected. The calculation results can be displayed on the display screen, and can go

through the hard copy printer alongside the terminal to display the result on paper." The teacher pointed to the terminal facility and said, "this terminal is also equipped with two box-like tape machines and can save programs and data for ease of use." The teacher also demonstrated the function of the long range terminal. He interpreted the machines for the students. "If production and interpretation devices are installed on the terminal a terminal located at a fairly large distance can be connected to the computer by means of a telephone. In this way we can use terminals in distant class rooms just like we use them alongside the computer.

Computer Center

There was not much time left remaining in the allotted tour time and there was still one place left to see: the computer center. It is set in a courtyard; in the courtyard new flowers were coming into bloom, and their fragrance filled the air, gladdening the heart and refreshing the spirit. A square building rose up in front of the students. They entered through a large door and saw a big room filled with many people hard at work, some examining keypunch cards, some correcting programs, some examining calculation results, some in discussion. According to the guiding teacher, some of those inside were Beijing Aerospace teachers, and some were comrades come from outside to calculate. Going through the second door was a big hall set off by glass -- spacious, bright, over 200 square meters in area. This was the main machine room of the computer center. Four machines were arranged inside; many tape machines neatly lined up on one side and tape plate machines on the other. There was also a card input output machine, a high speed wide printer, a large graphics machine, and other such external facilities: a complete set up. The technicians sat in front of the control board control machine. In order not to affect the orderly operation of the computer, we observed from around the surrounding glass windows.

We also observed the subsidiary rooms around the computer for service: the keypunch machine room, the terminal room, the air regulation machine room, the software and hardware rooms, and so on. We had a general understanding of the computer center work.

The guiding teacher explained to us: "aside from the responsibility for handling the course research for the entire school, the computer center also bears the responsibility for the graduating students designs and the research student theses calculations, and also had to handle the outside unit calculations, so its very busy. That's why it goes on three shifts all day and night.

When it was time to go the teacher said kindly, " when there is another opportunity, we welcome you all to come back again for a look around. I hope you all study hard in order to get excellent records to accept the mother country's challenge. We enthusiastically welcome you to throw yourselves into aircraft computer science technological work." The students enthusiastically clapped to show their thanks and their individual determination and hope.



Fig.1. Airborne Computers

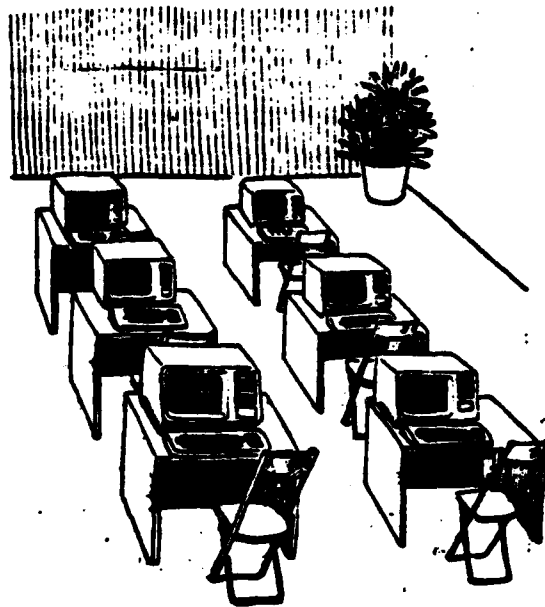


Fig.2. Terminals for student use.

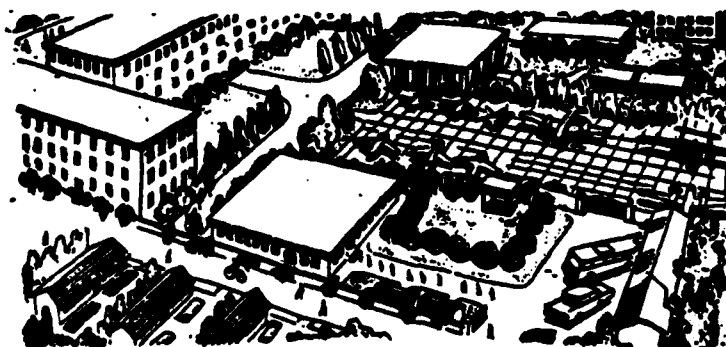


Fig.3. The computing center of Beijing Aeronautics Institute.

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